

**2600-HZ E3C, E4C, or E5C SINGLE-FREQUENCY SIGNALING CIRCUIT  
OUT-OF-SERVICE TESTS USING TESTING CIRCUIT  
SD-96519-01 OR SD-96519-02**

**1. GENERAL**

**1.01** This section describes methods of making out-of-service tests of 2600-Hz single-frequency signaling circuits per SD-99767-01 using testing circuits per SD-96519-01 or SD-96519-02. It also describes methods of making potentiometer adjustments to correct for changes in the characteristics of some circuit elements. If the requirements of this section cannot be met after readjustment of potentiometers or relays, the units should be returned to a repair center, since special techniques are involved in testing and clearing trouble in some of the components.

*Note:* 303-type relays shall be maintained in an upright position for not less than one minute before any test is begun.

**1.02** This section is reissued for the following reasons:

- (a) To change the title to include the E5C SF unit.
- (b) To change the title of Tests A, C, H, and J.
- (c) To change Tests B, C, D, E, F, G, and H to Tests C, E, J, F, G, H, and L, respectively.
- (d) To add Tests B, D, I, and K for using the 4A signaling test set.
- (e) To delete references to brief tests.
- (f) To delete references to the 13A TMS.
- (g) To make minor changes as necessary.

This reissue affects the Equipment Test Lists.

**1.03** The tests covered are:

	<b>PAGE</b>
<b>A. Pulsing of Transmitter A Relay—Using 2B Test Set:</b> This test checks that the A relay is properly following pulses and that the pulse corrector and cut circuit are functioning properly. . . . .	8
<b>B. Pulsing of Transmitter A Relay—Using 4A Test Set:</b> This test checks that the A relay is properly following pulses and that the pulse corrector and cut circuit are functioning properly. . . . .	9
<b>C. Hold of B Relay—Using 2B Test Set:</b> This test checks the B relay release time. . . . .	10
<b>D. Hold of B Relay—Using 4A Test Set:</b> This test checks the B relay release time. . . . .	11
<b>E. Transmitted Tone Level:</b> This test checks the level of the transmitted single-frequency tone. . . . .	12
<b>F. Test of 4-Wire Terminating Circuit, Gain of Receiving Voice Amplifier, Blocking of Amplifier, and Insertion of Band-Elimination Network:</b> The following features are checked: (1) transmission loss from 2-wire to 4-wire transmit and adjustment of TRNS potentiometer (2) transmission loss from 4-wire receive to 2-wire and adjustment of RCV potentiometer (3) transhybrid loss from 4-wire receive to 4-wire transmit (4) blocking of the voice amplifier by the received signal frequency and insertion of band-elimination network. . . . .	13

	PAGE
<b>G. Operate Sensitivity of Receiver Signaling Amplifier:</b> This test checks the receiver sensitivity and describes its adjustment by means of the SS potentiometer. . . . .	16
<b>H. Timing of Receiver R and RG Relays-Using 2B Test Set:</b> This test checks the operate and release of the R and RG relays. . . . .	17
<b>I. Timing of Receiver R and RG Relays-Using 4A Test Set:</b> This test checks the operate and release of the R and RG relays. . . . .	19
<b>J. Voice Amplifier Cutoff Transistor—Using 2B Test Set or VOM</b> . . . . .	20
<b>K. Voice Amplifier Cutoff Transistor—Using 4A Test Set:</b> This test checks the voice amplifier cut feature by pulsing SF tone through the LINE REC and measuring, at the EQPT REC, the initial portion of each pulse which is gated through the amplifier before the cut takes place. . . . .	20
<b>L. Receiver Guard Action:</b> This test checks the receiver guard circuit in limiting operation by voice signals. . . . .	21
<b>1.04</b> The J94021A (21A) transmission measuring set is referred to in this section as the TMS.	
<b>1.05</b> The 2B signaling test set is referred to in this section as 2B test set.	
<b>1.06</b> The 4A signaling test set is referred to in this section as 4A test set.	
<b>1.07</b> The KS-14510 volt-ohm-milliammeter, or equivalent, is referred to in this section as VOM.	
<b>1.08</b> The J98613AY test panel (SD-96519-01 or SD-96519-02) is referred to in this section as test circuit. KEYERS switch 1 and RECEIVER switch 2 on this panel are referred to as SW1 and SW2, respectively. Jacks and keys mentioned in	

this practice are part of the test circuit unless otherwise specified.

**1.09** Make percent break adjustments of the 2B test set slowly above 70 percent to prevent pulsing out incorrect values. Incorrect values will be obtained if the rate of vibration of the PERCENT BREAK meter pointer is not the same as that of the PULSES PER SECOND meter pointer. To restore correct percent break values, turn the ADJ % BK control counterclockwise until both pointers are vibrating at the same rate, turn the control slowly clockwise until the desired percent break value is obtained. It may also be necessary to change the coarse ADJ % BK control from S, M, or L setting to obtain the desired range on the PERCENT BREAK meter.

**1.10 Lettered Steps:** A letter a, b, c, etc, added to a step number in Part 3 or 4 of this section indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

**2. APPARATUS**

**2.01** The apparatus required for each test is shown in Table A. The details of each item are covered in the paragraph indicated by the number in parentheses.

**2.02** Test circuit, J98613AY (SD-96519-01 or SD-96519-02) including folding test fixture J98613AC.

**2.03** 2B test set, J64730B (SD-56134-02) W option or later includes power cords.

**2.04** KS-14510 volt-ohm-milliammeter, or equivalent, including testing leads.

**2.05** 4A test set, J94743A (SD-1C244-01), including E&M interface unit, J94743AD and SF interface unit, J94743AA.

**2.06** The J94021A (21A) transmission measuring set (TMS).

TABLE A

APPARTUS	TESTS											
	A	B	C	D	E	F	G	H	I	J	K	L
Test Circuit (2.02)	1	1	1	1	1	1	1	1	1	1	1	1
2B Test Set (2.03) or VOM (2.04)	1		1			1				1		
4A Test Set (2.05)		1		1			1				1	
TMS (2.06)	1	1			1			1	1			1
Cord (2.07)	1		1							1		
Cord (2.08)	1		1							1		
Cord (2.09)						1						
Cord (2.10)	1	1		1	1		1	1	1		1	1
Cord (2.11)	1											
258D (dummy) Plug	1		1							1		
Screwdriver, C	1	1	1		1	1	1	1	1		1	1
Tool (2.12)	1	1	1	1	1	1	1	1	1	1	1	1
Blocking Tool (2.13)	√							√				

√ As required

- 2.07** Patching cord, P2A cord, 6 feet long, equipped with two 347A plugs (2P1D cord).
- 2.08** Patching cord, P2A cord, 6 feet long, equipped with two 347B plugs (2P3B cord).
- 2.09** Patching cord, P3E cord, 6 feet long, equipped with two 310 plugs (3P7A cord).
- 2.10** Patching cord, P3N cord, 6 feet long, equipped with a 241A plug and 310 plug (3P17B cord).
- 2.11** Testing cord, 2 feet long, equipped with 8-pin (male) Jones plug, KS-8585 L10 and 347 plug (P1P cord).
- 2.12** 725A tool, used to gain mechanical advantage in prying loose the signaling units from connectors.
- 2.13** Blocking and insulating tools, as required. Use tools and apply as covered in Section 069-020-801.

### 3. PREPARATION

STEP	ACTION	VERIFICATION
------	--------	--------------

#### All Tests

- At test circuit—  
Set all keys to normal position before starting any tests.

**Note:** The twist keys in the test circuit are operated when the white line is in the vertical position and normal when the white line is in the horizontal position.

- Obtain release of signaling circuit in accordance with approved procedures.

STEP	ACTION	VERIFICATION
3	Using 725A tool as shown in Fig. 1 or 2, remove signaling unit from its in-service position.	
4	Plug signaling unit into folding test fixture.	
5	Operate 2-WIRE key.	
6a	If test circuit is mounted in a REVERTIVE-TERMINATING bay, J98613AP— Turn CT key to operate position.	

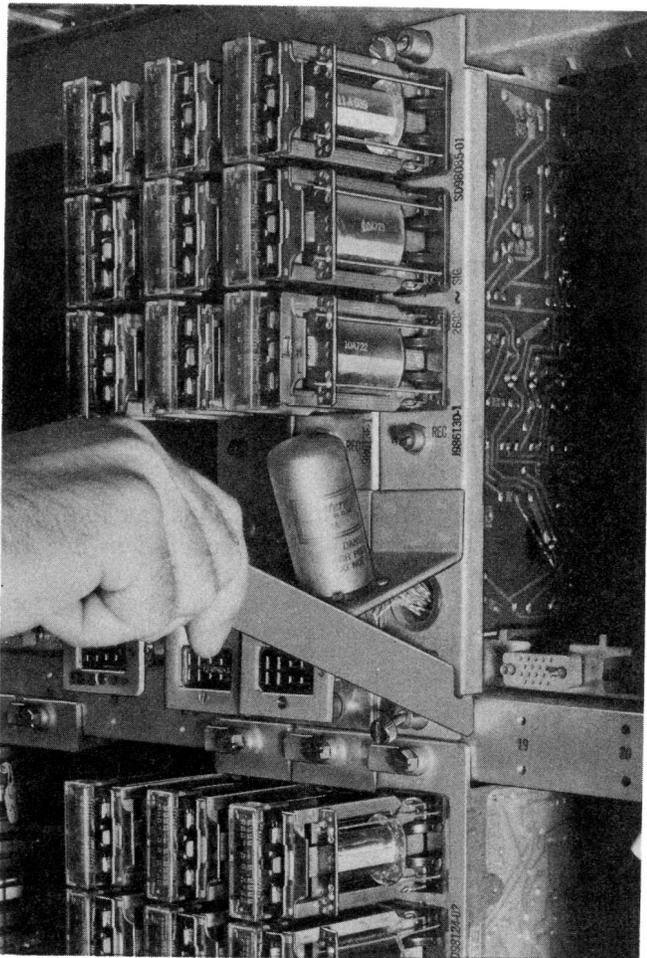


Fig. 1—Method of Removal of Fabricated Chassis

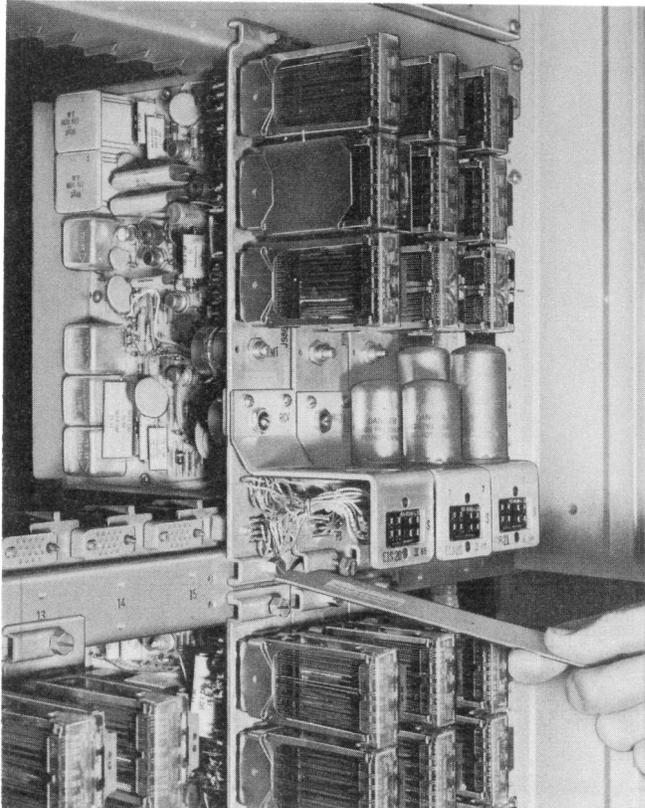
Tests A, B, E, F, G, and L

*Note:* The tip or ring of line transmit terminals must not be connected to ac or dc ground. See SD-99767-01.

## STEP

## ACTION

## VERIFICATION



**Fig. 2—Method of Removal of Die-Cast Chassis**

- 7 Calibrate TMS if necessary.
- 8 Using P3N cord, connect DET IN jack of TMS to SF UP jack of test circuit.
- 9 Disconnect plug from SF SUP jack, connect to AMP OUT jack of test circuit.
- 10 Set SW2 to position 2.

TMS indicates between  $-14.6$  and  $-16.1$  dB.

**Note:** The 21A TMS requires that the DET INPUT switch be set to the proper position for each measurement. The TMS indications called for as verification in this section are the combined total of the DET INPUT switch setting and the meter indication. The TMS should be correctly calibrated before using.

TMS indicates 0 dB.  
See Step 11b.

SECTION 179-353-501

STEP	ACTION	VERIFICATION
11b	If requirement of Step 10 is not met— Adjust gain control of MON amplifier to obtain 0 dB.	
12	Disconnect plug from AMP OUT jack, connect to TMS jack of test circuit.	
<b>Tests A, C, H, and J</b>		
13	Using 2P3B and 2P1D cords, patch E and M jacks of test circuit to E and M jacks of 2B test set.	
14	At 2B test set— Set all keys to normal position.	
15	Set SCALE SEL switch to PPS.	
16	Plug power cords of 2B test set into A and B jacks of test circuit.	After 1 minute, PULSES PER SECOND meter indicates other than 0.
17	Operate CONT PLS key to DIAL PLS.	PERCENT BREAK meter indicates 0 on <b>black</b> scale. See Step 18C.
18c	If requirement of Step 17 is not met— Adjust pointer adjustment screw of PERCENT BREAK meter to obtain 0.	
19	Insert 258D plug into P jack.  <b>Note:</b> Repeat Steps 19 through 21 if test extends beyond 30 minutes.	PERCENT BREAK meter indicates 100 on <b>black</b> scale. See Step 20d.
20d	If requirement of Step 19 is not met— Unlock CAL % BK control, adjust to obtain indication of 100 on <b>black</b> scale of PERCENT BREAK meter and relock control taking care not to change 100 indication.  <b>Note:</b> The proper performance of the test covered in this section depends upon the correct pulse-per-second calibration and the range of the 2B test set. See Section 100-263-501 for calibration if accuracy is not known.	
21	Remove 258D plug.	
22	Restore CONT PLS key to normal.	

STEP	ACTION	VERIFICATION
------	--------	--------------

**Tests B, D, I, and K**

- |    |  |  |
|----|--|--|
| 23 | Connect 4A test set to 110 volts ac, operate POWER switch to ON.   |  |
| 24 | Equip 4A test set with E&M and SF interface units.   |  |
| 25 | Using P3N cord, connect LINE/R jack of 4A test set to E jack and M jack of test circuit, with notched side of 241 plug toward E jack of test circuit.      |  |
| 26 | At 4A test set—<br>Set MS RANGE switch to 999.   |  |
| 27 | Set READ switch to MSEC UPDATE.  |  |
| 28 | Set FUNCTION switch to MSEC BK or MSEC MK.   |  |
|    | <i>Note:</i> When verification calls for an indication in ms break or ms make, set the FUNCTION switch accordingly to obtain the proper indication.        |  |
| 29 | Set SELECTOR switch to NORM.   |  |
| 30 | Set RECEIVE switch to EM.  |  |
| 31 | Set SEND switch to EM.   |  |
| 32 | Set PULSE MODE switch to CONT.   |  |
| 33 | At E&M interface unit—<br>Operate TWD LINE key to OFF HK.  |  |
| 34 | Operate TWD DROP key to ON HK.   |  |
| 35 | Operate PULSE/MEAS key to LINE.  |  |
| 36 | Set E&M/CX-S/R switch to E&M/CX.   |  |
|    | <i>Note:</i> The OPERATE-CLEAR key and the START-STOP key are operated when the lamp behind the key is lighted and released when the lamp is extinguished. |  |
| 37 | Operate START-STOP key.  |  |
| 38 | Operate OPERATE-CLEAR key.   |  |

## 4. METHOD

STEP	ACTION	VERIFICATION
<b>A. Pulsing of Transmitter A Relay—Using 2B Test Set</b>		
23	At 2B test set— Restore all keys to normal.	
24	At test circuit— Set SW1 to position 7, SW2 to position 1.	
25	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter (0 to 20 scale).	
26	With coarse ADJ % BK switch on M— Adjust ADJ % BK control to 55 on <i>black</i> scale of PERCENT BREAK meter.	
27	Operate TWD L key to OFF HK.	
28	Operate PLS, MEAS % BK keys to LINE.	PERCENT BREAK meter indicates 55 on <i>black</i> scale. See Step 29e.
29e	If requirement of Step 28 is not met— Adjust M potentiometer of test circuit to 55 on <i>black</i> scale of PERCENT BREAK meter.	
30	Adjust ADJ % BK control to 45 on <i>black</i> scale of PERCENT BREAK meter.	
31	At test circuit— Set SW1 to position 2.	
32	Operate E1C, E1C 2 keys.	
33	Depress MIN LP key.	At SF unit— A relay pulses, B relay operated.
34	Simultaneously depress TMS A, TMS B keys.  <i>Note:</i> The indications in verification depend upon the TRNS potentiometer for a -16 dBm TLP. Perform Test F, Steps 13 through 17.	For E3C units, TMS indicates between -14 and -20 dB with pulsating swings. For E4C, E5C units, TMS indicates between -26 and -31 dB with pulsating swings.
35	Release MIN LP, TMS A, TMS B keys.	A, B relays released.
36	Set SW1 to position 7.	

STEP	ACTION	VERIFICATION
37	At 2B test set— Adjust ADJ % BK control to 70 on <i>black</i> scale of PERCENT BREAK meter.	
38	At test circuit— Set SW1 to position 2.	
39	Depress MAX LP key.	At SF unit— A relay pulses, B relay operated.
40	Simultaneously depress TMS A, TMS B keys.	For E3C units, TMS indicates between -13 and -19 dB with pulsating swings. For E4C, E5C units, TMS indicates between -25 and -30 dB with pulsating swings.
41	Release MAX LP, TMS A, TMS B keys.	A, B relays released.
42	Restore E1C and E1C 2 keys.	
43f	If no other tests are to be made— Restore all keys, remove all test cords, restore all circuits to normal.	

**B. Pulsing of Transmitter A Relay—Using 4A Test Set**

39	Set PULSE PERIOD switch to 100.	
40	Set PULSE WIDTH switch to 55.	
41	At test circuit— Set SW1 to position 7.	
42	Set SW2 to position 1.	
43	At 4A test set— Operate GEN SUPV key to OFF HK.	4A display indicates 45 ms make. See Step 44e.
44e	If requirement of Step 43 is not met— Adjust M potentiometer of test circuit to obtain 45.	
45	Set PULSE WIDTH switch to 45.	
46	At test circuit— Set SW1 to position 2.	
47	Operate E1C 1, E1C 2 keys.	
48	Depress MIN LP key.	At SF unit— A relay pulses, B relay operated.

SECTION 179-353-501

STEP	ACTION	VERIFICATION
49	Simultaneously depress TMS A, TMS B keys.  <i>Note:</i> The indications in verification depend upon setting the TRNS potentiometer for a -16 dBm TLP. Perform Test G, Steps 13 through 17.	TMS indicates -14 to -20 dB for E3C units or -26 to -31 dB for E4C, E5C units, with pulsating swings.
50	Release MIN LP, TMS A, TMS B keys.	A, B relays released.
51	At 4A test set— Set PULSE WIDTH switch to 70.	
52	At test circuit— Depress MAX LP key.	At SF unit— A relay pulses, B relay operated.
53	Simultaneously depress TMS A, TMS B keys.	TMS indicates -13 to -19 dB for E3C units or -25 to -30 dB for E4C, E5C units, with pulsing swings.
54	Release MAX LP, TMS A, TMS B keys.	A, B relays released.
55f	If no other test are to be made— Restore all keys, remove all test cords, restore all circuits to normal.	

C. Hold of B Relay—Using 2B Test Set

23	At test circuit— Set SW1 and SW2 to position 1.	
24	At 2B test set— Adjust ADJ PPS control to 3 pps on PULSES PER SECOND meter.	
25	With coarse ADJ 5 BK control on L— Adjust ADJ % BK control to 80 on <i>black</i> scale of PERCENT BREAK meter.	
26	Operate TWD L key to OFF HK.	
27	Operate PLS, MEAS % BK keys to LINE.	
28	At test circuit— Operate E1C 1, E1C 2 keys.	
29	Depress MAX LP key.	At SF unit— A relay pulses while B relay remains operated.  S lamp lighted at test circuit. See Step 45e.

STEP	ACTION	VERIFICATION
30	Release MAX LP key.	A, B relays released. S lamp extinguished at test circuit. See Step 31e.
31E	If requirements of Steps 29 and 30 are not met— Mechanical and electrical requirements of A, B relays should be checked and Steps 38 through 44 repeated if any adjustments are made.	
32	At 2B test set— Restore PLS, MEAS % BK keys to normal.	
33	At test circuit— Depress MAX LP key.	At SF unit— A, B relays operated.
34	Release MAX LP key.	A relay is released.
	<b>Note:</b> Steps 47 and 48 may be repeated in order to observe release time of B relay.	In less than 1 second— B relay released. See Step 35f.
35f	If requirements of Step 34 are not met— Check requirements of B relay and repeat Steps 24 through 34 if any adjustments are made.	
36	At 2B test set— Restore TWD L key to normal.	
37	Adjust ADJ & BK control to 20 on <i>black</i> scale of PERCENT BREAK meter.	
38	At test circuit— Restore E1C 1, E1C 2 keys to normal.	
39g	If no other tests are to be made— Remove all cords, restore all keys to normal, and return signaling unit to service or spare position.	

#### D. Hold of B Relay—Using 4A Test Set

39	Set PULSE PERIOD switch to 333.
40	Set PULSE WIDTH switch to 266.
41	At test circuit— Set SW1 to position 1.
42	Set SW2 to position 1.

**SECTION 179-353-501**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
43	Operate E1C 1, E1C 2 keys.	
44	At 4A test set— Operate GEN SUPV key to OFF HK.	
45	At test circuit— Depress MAX LP key.	At SF unit— A relay pulses. B relay operated and remains operated during pulsing. At test circuit— S lamp lighted during pulsing. See Step 45e.
46	Release MAX LP key.	At SF unit— A, B relays released at test circuit— S lamp extinguished. See Step 45e.
47e	If requirements of Step 43 or 44 are not met— Check mechanical and electrical requirements of A, B relays then repeat Steps 37 through 4A.	
48	At 4A test set— Release OPERATE-CLEAR key.	
49	At test circuit— Depress MAX LP key.	At SF unit— A, B relays operated.
50	Release MAX LP key.	A relay released. B relay released in less than one second. See Step 51f.
51f	If requirements of Step 50 are not met— Check mechanical and electrical requirements of B relay then repeat Steps 39 and 50.	
52	At 4A test set— Operate GEN SUPV key to ON HK.	
53g	If no other tests are to be made— Restore all keys, remove all test cords, restore all circuits to normal.	

**E. Transmitted Tone Level**

- |    |  |
|----|--|
| 13 | At test circuit—<br>Operate E1C 1, E1C 2 keys. |
| 14 | Set SW1 to position 3, SW2 to position 1.      |

STEP	ACTION	VERIFICATION
15	Simultaneously depress TMS A, TMS B keys.	TMS indicates between -35 and -37 dB.
16	Release TMS A, TMS B keys.	
17	Set SW1 to position 4.	
18	Simultaneously depress TMS A, TMS B, MAX LP keys.	A, B relays operated. TMS indicates less power than -45 dBm.
19	Release TMS A, TMS B, MAX LP keys.	A, B relays released.
20	Simultaneously depress TMS A, TMS B keys.	
21	Manually operate B relay.	TMS indicates between -22 and -25 dB.
22	Release TMS A, TMS B keys and B relay.	
23	Restore E1C 1, E1C 2 keys to normal.	
24c	If no other tests are to be made— Remove all cords, restore all keys to normal, and return signaling unit to service or spare position.	
<b>F. Test of 4-Wire Terminatin Circuit, Gain of Receiver Voice Amplifier, Blocking of Amplifier, and Insertion of Band-Elimination Network</b>		
<b>2-Wire to 4-Wire Loss</b>		
13	Operate 1000~ A key.	
14	Set SW1 to position 5, SW2 to position 2.	
15	Operate BAT LP key.	
16	Operate LP CUR 1 key.	At SF unit— A, B relays operated.
17	At test circuit— Simultaneously depress TMS A, TMS B keys.	TMS indicates -16 dBm or as specified for transmit TLP as shown on circuit layout record minus 0.2 dB.
18	Adjust TRNS potentiometer of signaling unit fully counterclockwise.	TMS indicates -40 dBm or less power.
19	Adjust TRNS potentiometer of signaling unit fully clockwise.	TMS indicates -13 dBm or greater power.
20	Adjust TRNS potentiometer of signaling unit for specific 2-wire to 4-wire loss.	TMS indicates specified value shown for signaling unit on trunk layout record minus 0.2 dB.

**SECTION 179-353-501**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
21	Restore LP CUR 1 key to normal.	A, B relays released. TMS indicates -45 dBm or less power.
22	Operate LP CUR 1 key.	A, B relays operated.
23	Release TMS A, TMS B keys.	
24	Restore 1000~A key to normal.	
<b>4-Wire to 2-Wire Loss</b>		
25	At test circuit— Operate 1000~B key.  <i>Note:</i> Minor adjustments of RCV potentiometer of less than 1 dB may be made to meet overall trunk net loss requirements in an in-service condition.	TMS indicates -9 dBm or as specified for receive TLP as shown on circuit layout record Plus 0.2 dB.
26	Set RCV potentiometer of signaling unit fully counterclockwise.	TMS indicates -39 dBm or less power.
27	Adust RCV potentiometer to full clockwise position.	TMS indicates +1 dBm or greater power.
28	Adjust RCV potentiometer to obtain exactly 0 dB.	TMS indicates 0 dB.
29	At SF unit— Manually operate RG relay.	TMS indicates -1.0 dB of power or more.
30	Release RG relay.	
31	At test circuit— Depress TMS A, TMS B keys simultaneously.	TMS indicates -11 to -18 dB.
32	Operate 2W TER key.	TMS indicates at least 15 dB less power than indicated in Step 31.
33	Restore 2W TER key to normal.	
34	Release TMS A, TMS B keys.	
35	Set attenuator to 0.	
36	At test circuit— Restore LP CUR 1, 1000~B keys to normal.	A, B relays released.
37	Set SW1 to position 6, SW2 to position 4.	
38	Set attenuator to 10.	TMS indicates $0 \pm 0.2$ dB. See Step 39e.

STEP	ACTION	VERIFICATION
39e	If requirement of Step 38 is not met— Adjust gain potentiometer of TST amplifier to obtain 0 dB.	
40	Set SW1 to position 5, SW2 to position 3.	
41	Operate LP CUR 1 key.	At SF unit— A, B relays operated.
42	Block nonoperated RG relay.	
43	At test circuit— Set SW1 to position 6.	TMS indicates -36 dBm or less power.
44	Remove blocking tool from RG relay.	RG relay operated. See Step 45f.
45f	If RG relay does not operate— Perform Test H, then repeat Steps 37 through 44, before continuing with this test.	
46	At test circuit— Restore LP CUR 1 key to normal.	A, B relays released. TMS indicates -30 dBm or less power.
	<i>Note:</i> If the test circuit is mounted in a REVERTIVE-TERMINATING bay and the CRT key is operated, a TMS indication of -28 dBm or less power is satisfactory.	
47g	If the requirement of Step 46 is not met— Adjust the oscillator of the 21A TMS to 2600 $\pm$ 10 Hz, at a level of -15.6 dBm, and connect it to the SF TST jack.	TMS indicates -30 dBm or less power.
48g	Set SW1 to position 5, SW2 to position 2.	At SF unit— RG relay released.
49	At test circuit— Operate LP CUR 1 key.	At SF unit— A, B relays operated.
50	Operate 1000~B key.	TMS indicates 0 dB.
51	Adjust RCV potentiometer of signaling unit for specific 4-wire to 2-wire loss.	TMS indicates specified value shown for signaling unit on trunk layout record plus 0.2 dB.
	<i>Note:</i> Minor readjustments of RCV potentiometer of less than 1 dB may be made to meet overall trunk net loss requirements in an in-service condition.	

**SECTION 179-353-501**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
52	At test circuit— Restore LP CUR 1, 1000~B keys to normal, BAT LP key to BAT.	A, B relays released.
53	Set SW2 to position 4.	
54h	If no other tests are to be made— Remove all cords, restore all keys to normal, and return signaling unit to service or spare position.	
<b>G. Operate Sensitivity of Receiver Signaling Amplifier</b>		
13	At test circuit— Set SW1 to position 6, SW2 to position 4.	
14	Set attenuator to 10.	TMS indicates $0 \pm 0.2$ dB. See Step 15c.
15c	If requirement of Step 14 is not met— Adjust gain control of TST amplifier for 0 dB indication on TMS.	
16	Set attenuator to 34.	
17	Set SW2 to position 3.	At SF unit— RG relay released. See Step 18d.
18d	If RG relay operated— Adjust SS potentiometer of signaling unit slightly counterclockwise until RG relay releases.	RG relay remains released.
19	Set attenuator to 32.	RG relay operated. See Step 20e.
20c	If RG relay does not operate— Increase setting of SS potentiometer until it just operates.	
21e	Repeat Steps 16 through 19 until the requirements of Steps 17 and 19 are met, starting with SW2 in position 4.	
22	Set attenuator to 40.	RG relay released.
23	Set SW1 to position 5.	
24f	If no other tests are to be made— Remove all cords, restore all keys to normal, and return signaling unit to service or spare position.	

STEP	ACTION	VERIFICATION
<b>H. Timing of Receiver R and RG Relays—Using 2B Test Set</b>		
	<i>Note:</i> Test G should be performed before beginning Test H.	
23	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter (0 to 20 scale).	
24	With coarse ADJ % BK switch on M— Adjust ADJ % BK control for 55 on <i>black</i> scale of PERCENT BREAK meter.	
25	At test circuit— Set SW1 to position 7.	
26	At 2B test set— Operate TWD L key to OFF-HK.	
27	Operate PLS, MEAS % BK keys to LINE.	PERCENT BREAK meter indicates 55 on <i>black</i> scale. See Step 28e.
28e	If requirement of Step 27 is not met— Adjust M potentiometer of test circuit to 55 on <i>black</i> scale of PERCENT BREAK meter.	
29	Set attenuator to 11.	
30	At 2B test set— Adjust ADJ % BK control to 40 on <i>black</i> scale of PERCENT BREAK meter.	
31	Turn ADJ PPS control counterclockwise to 3 PPS on PULSES PER SECOND meter.	
32	At test circuit— Set SW1 to position 8, SW2 to position 3.	RG relay does not pulse uniformly as indicated by intermittent indication of greater than 0 on PERCENT BREAK meter <i>red</i> scale. See Step 33f.
<b>Adjust OT</b>		
33f	If requirement of Step 32 is not met— At signaling unit— Turn OT potentiometer fully counterclockwise and then turn clockwise until RG relay just pulses intermittently.	Intermittent indication on PERCENT BREAK meter <i>red</i> scale of greater than 0.

SECTION 179-353-501

STEP	ACTION	VERIFICATION
<i>Adjust RT</i>		
34	At test circuit— Set SW1 to position 7.	
35	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter.	
36	Adjust ADJ % BK control very slowly to 80 on <b>black</b> scale of PERCENT BREAK meter.	
37	Turn ADJ PPS control counterclockwise to 3 PPS on PULSES PER SECOND meter.	
38	At test circuit— Set SW1 to position 8.	PERCENT BREAK meter indicates 20 to 26 on <b>red</b> scale. See Step 39g.
39g	If requirement of Step 38 is not met— At signaling unit, turn RT potentiometer fully counterclockwise then turn clockwise until 24 is obtained.	
<i>Ringback Response</i>		
40	Set SW1 to position 7.	
41	At 2B test set— Adjust ADJ % BK control to 21 on <b>black</b> scale.	
42	At test circuit— Set SW1 to position 8.	PERCENT BREAK meter indicates more than 18 on <b>red</b> scale.
43	Set SW1 to position 7.	
44	At 2B test set— With coarse ADJ % BK control on L— Adjust ADJ % BK control to 39 on <b>black</b> scale.	
45	At test circuit— Set SW1 to position 8.	PERCENT BREAK meter indicates less than 42 on <b>red</b> scale.
46	At 2B test set Restore all keys to normal.	
47h	If no other tests are to be made on this unit— Restore all keys to normal and return signaling unit to service or spare position.	

STEP	ACTION	VERIFICATION
<b>I. Timing of Receiver R and RG Relays Using 4A Test Set</b>		
	<i>Note:</i> Test G should be performed before beginning Test I.	
39	Set PULSE PERIOD switch to 100.	
40	Set PULSE WIDTH switch to 55.	
41	At test circuit— Set SW1 to position 7.	
42	At 4A test set— Operate GEN SUPV key to OFF HK.	4A display indicates 45 ms break. See Step 43e.
43e	If requirement of Step 42 is not met— Adjust M potentiometer of test circuit to obtain 45.	
44	At 4A test set— Set PULSE PERIOD switch to 333.	
45	Set PULSE WIDTH switch to 133.	
46	At test circuit— Set attenuator to 11.	
47	Set SW1 to position 8.	
48	Set SW2 to position 3.	4A display indicates 0 to 80 ms break, indicating RG relay not pulsing uniformly. See Step 49f.
49f	If requirement of Step 48 is not met— At SF unit— Turn OT potentiometer fully counterclockwise, then turn clockwise until RG relay starts pulsing.	4A display indication is unstable.
50	At 4A test set— Set PULSE WIDTH switch to 80.	4A display indicates 67 to 87 milliseconds break. See Step 51g.
51g	If requirement of Step 50 is not met— At SF unit— Turn RT potentiometer fully counterclockwise, then turn clockwise until 4A display indicates 80 milliseconds break.	
52	At 4A test set— Set PULSE WIDTH switch to 70.	4A display indicates 60 milliseconds break or more.

**SECTION 179-353-501**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
53	Set PULSE WIDTH switch to 130.	4A display indicates 140 milliseconds break or less.
54h	If no other tests are to be made— Restore all keys, remove all test cords, restore all circuits to normal.	

**J. Voice Amplifier Cutoff Transistor—Using 2B Test Set or VOM**

23	At test circuit— Set SW1 to position 5.	
24	Set SW2 to position 1.	
25e	If using 2B test set— Using P3E cord, connect SENS 1 jack of test circuit to VM jack of 2B test set.	
26e	At 2B test set— Set SCALE SEL switch to 20V.	Voltmeter of 2B test set indicates 0.8 volt or less.
27e	Remove cord from SENS 1, VM jacks.	
28e	Set SCALE SEL switch to PPS.	
29f	If using VOM— Connect the 310 plug of W2CF cord to SENS 1 jack of test circuit.	
30f	At VOM— Set selector switch to 3 VOLTS DC position.	
31f	Connect positive (+) lead of VOM to 360C (white) tool of W2CF cord.	
32f	Connect negative (–) lead of VOM to 360B (black) tool of W2CF cord.	VOM indicates 0.8 volt or less.
33f	Remove cord from SENS 1 jack and VOM.	
34g	If no other tests are to be made— Remove all cords, restore all keys, restore all circuits to normal.	

**K. Voice Amplifier Cutoff Transistor—Using 4A Test Set**

39	Disconnect cord from DET IN jack of TMS, connect to FROM LINE jack of SF interface unit.	
----	--	--

STEP	ACTION	VERIFICATION
40	At 4A test set— Operate PULSE/MEAS key of SF interface unit to LINE.	
41	Operate TWD EQPT key of SF interface unit to OFF HK.	
42	Operate TWD LINE key of SF interface unit to MON.	
43	Set NB-BB switch of SF interface unit to NB.	
44	Operate TWD LINE key of E&M interface unit to OFF HK.	
45	Set RECEIVE switch to SF.	
46	Set PULSE PERIOD switch to 500.	
47	Set PULSE WIDTH switch to 50.	
48	At test circuit— Set SW1 to position 8.	
49	Set attenuator to 11.	
50	Set SW2 to position 3.	
51	At 4A test set— Operate START-STOP key.	
52	Operate OPERATE-CLEAR key.	Display indicates 5 to 25 ms break. See Step 53e.
53e	If requirement of Step 52 is not met— Perform Test I, then repeat Test K.	
54f	If no other tests are to be made— Restore all keys, remove all cords, restore all circuits to normal.	

#### L. Receiver Guard Action

13	At test circuit— Set SW1 to position 5, SW2 to position 6.	TMS indicates between $-18.5$ and $-19.5$ dB.
14	Set attenuator to 26.	
15	Set SW2 to position 5.	RG relay released.
16	Set SW1 to position 6.	RG relay remains released.

**SECTION 179-353-501**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
17	Set SW1 to position 5.	
18	Change attenuator to 19.	
19	Set SW1 to position 6.	RG relay operated.
20	Set SW1 to position 5.	RG relay released.
21	Restore all keys to normal and return signaling unit to service or spare position.	